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11-28-01

Attorney Docket No.: 94-36-3-US-D1
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Werenicz et al.

Serial No.: 09/057,406

Filed: April 8, 1998

Title: METHOD FOR PRODUCING A CONTINUOUS THERMOPLASTIC COATING

Assistant Commissioner for Patents

Washington, D.C. 20231

BOX AF

Art Unit: 1733

Examiner: J. Aftergut

DECLARATION OF MARK KROLL

I, Mark Kroll, state and declare as follows:

1. I hold a B.S in Chemistry from the University of Minnesota.
2. I have been employed as a Chemist by the H.B. Fuller Company since 1979.
3. I have worked in the field of adhesive compositions and extrusion coating devices since 1989.
4. The viscosity of a composition has a direct bearing on the extrusion methods that are available for use with the composition. The viscosity of a composition is a primary property used in selecting an extrusion method for the composition.
5. I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine, imprisonment, or both, under Section 1001 of title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent on which this statement is directed.

Further I declare not.

Date: 10-23-01

Mark Kroll
Mark Kroll
Senior Section Leader
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St. Paul, Minnesota

Hytrel polymers have relatively flat viscosity versus shear rate curves, especially at low shear rates that are typical for extrusion. This means, for example, that high-shear screw and die designs will not reduce the melt viscosity of Hytrel as much as with some other polymers, but may cause undesirable local temperature increase.

From Figure 2 it can be seen that a significant change in melt viscosity can result from a relatively small change in melt temperature. The extrusion melt temperature can therefore be decreased to provide greater melt strength for improved stability of the extrudate. It also means that good control of melt temperature is an important factor in successful extrusion of Hytrel resins.

Basic Extrusion Equipment

General Design of Extruder

Experience has shown that the best results with Hytrel are obtained with a single screw extruder design. Twin screw extruders tend to generate excessive shear heating effects and are not recommended. Vented machines can not be used to dry Hytrel.

The emphasis in equipment selection should be on the uniformity and quality of melt produced. A constant delivery of homogeneous melt of uniform temperature, with the ability to maintain the desired melt temperature over a wide range of screw speeds, should be the objective for good extrusion.

Materials of Construction

Hytrel engineering thermoplastic elastomer in the molten state is noncorrosive to metals. Screws

should have hardened (nitrided) surfaces but need not be made of corrosion-resistant alloys, although many standard extruder barrels and screws are made from such materials in order to process a wide range of materials.

Extruder Drive

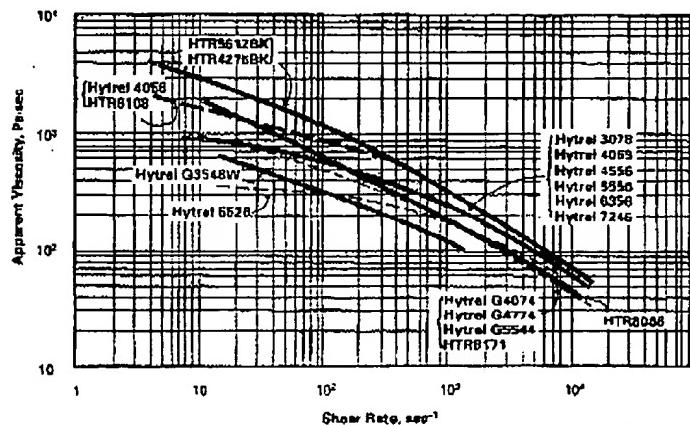
D.C. motors with thyristor drive are recommended, since they provide good speed control and infinitely variable adjustment of speed over a large range. Such drives normally provide automatic current limitation to prevent screw breakage as a result of excessive torque. Whatever type of drive is used, it is essential that some form of overload safety device is incorporated in the drive system. Additional protection should be provided by means of a rupture disc installed in the zone between the extruder screw and breaker plate/screen pack, or a pressure transducer with high pressure cut-out interlocked to the extruder drive.

Material Hopper and Feed Throat

Overhead or tangential-type feed throats, as normally provided on single screw extruders, work well with Hytrel. Water-cooling of the throat is recommended to prevent excessive heating of the resin entering the screw and to serve as protection for the drive bearings.

Hopper drying is not essential, but should be used, where available, to protect the polymer from additional moisture pickup. A hopper drier is also recommended to ensure the resin is supplied to the extruder at a constant temperature and moisture content, which can help to guarantee regular feeding and melting characteristics.

Figure 1. Melt Viscosity at Processing Temperature



| Type of Hytrel | Processing Temperature, °C (°F) |
|----------------|---------------------------------|
| Hytrel G3548W | 190 (374) |
| Hytrel 4074 | 200 (392) |
| Hytrel 6474 | 230 (446) |
| Hytrel G5544 | 230 (446) |
| Hytrel 3078 | 190 (374) |
| Hytrel 4059 | 190 (374) |
| Hytrel 4556 | 230 (446) |
| Hytrel 5556 | 230 (446) |
| Hytrel 6358 | 230 (446) |
| Hytrel 7246 | 230 (446) |
| Hytrel 4069 | 230 (446) |
| Hytrel 4556 | 230 (446) |
| Hytrel 5526 | 230 (446) |
| Hytrel 5556 | 230 (446) |
| Hytrel 6358 | 230 (446) |
| Hytrel 7248 | 240 (464) |
| HTR4275BK | 230 (446) |
| HTR5612BK | 230 (446) |
| HTR6108 | 190 (374) |
| HTR8068 | 190 (374) |
| HTR8171 | 190 (374) |